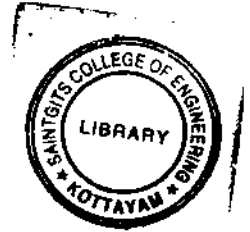# B.TECH. DEGREE EXAMINATION, MAY 2014

Fourth Semester

Branch : Mechanical Engineering

HYDRAULIC MACHINES (M)

(Old Scheme—Supplementary/Mercy chance)

[Prior to 2010 Admissions]

Time : Three Hours

Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 4 marks.

1. Briefly explain the principle of similitude.

2. Obtain an expression for the force exerted by a jet of water on a fixed vertical plate in the direction of the jet.

3. **Define specific speed of a turbine.**

4. Write a note on selection of turbines.

5. What do you mean by 'net positive suction head' ?

6. How will you classify impellers of a centrifugal pump ?

7. Briefly explain the principle of self-priming pump.

8. Define and explain slip in a reciprocating pump.

9. Differentiate between rotary axial and rotary radial piston pumps.

10. Discuss the effect of surface texture on the performance of the pump.

(10 × 4 = 40 marks)

Part B

Answer **all** *questions.*
Each question carries 12 marks.

11. A jet of water of diameter 50 mm, having a velocity of 20 m/s strikes a curved vane which is moving with a velocity of 10 m/s in the direction of the jet. The jet leaves the vane at an angle of 60° to the direction of motion of vane at outlet. Determine :

Turn over

(a) The force exerted by the jet on the vane in the direction of motion.

(b) Work done per second by the jet.

(12 marks)

Or

12. A small ship is fitted with jets of total area 0.65 m^2. The velocity through the jet is 9 m/s and speed of the ship is 18 kmph in sea water. The efficiencies of the engine and pump are 85% and 65% respectively. If the water is taken amid-ships, determine the propelling force and the overall efficiency, assuming the pipe losses to be 10% of the kinetic energy of the jets.

(12 marks)

13. Discuss the constructional features and performance characteristics of a Francis turbine. How is it different from a Kaplan turbine ?

(12 marks)

Or

14. A Pelton wheel is to be designed for the following specifications :—

Shaft power = 11, 772 kW ;

Head = 380 m ; speed = 750 r.p.m.

Overall efficiency = 86 % ; jet diameter is not to exceed one-sixth of wheel diameter.

Determine :—

(a) The wheel diameter.

(b) The number of jets required.

(c) Diameter of the jet.

(12 marks)

15. Prove that the manometric head of a centrifugal pump running at speed N and giving a discharge Q may be written as :

$H_{mano} = AN^2 + BNQ + CQ^2$ where A, B and C are constants.

(12 marks)

Or

16. Derive an expression for minimum speed for starting a centrifugal pump.   (12 marks)

17. Explain all the aspects of condition monitoring of different pumps. (12 marks)

Or

18. Discuss the effect of vapour pressure on lifting of liquid in positive displacement pumps.

(12 marks)

19. Write short notes on :—

    (i) Rotary axial piston pump. (6 marks)

    (ii) Hydraulic capstan. (6 marks)

Or

20. Find the efficiency of a hydraulic crane, which is supplied 300 litres of water under a pressure of 60 N/cm² for lifting a weight of 12 kN through a height of 11 m.

[5 × 12 = 60 marks]